WALL STRUCTURE SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS - Not Applicable

Statement Regarding Federally Sponsored Research or Development – Not Applicable

Reference to Microfiche Appendix – Not Applicable

BACKGROUND OF THE INVENTION

This invention is directed to a wall structure system, and in particular to a wall frame structure incorporating load-bearing integrated thrust members arranged in inclined back-to-back contained relation within a containing framework.

2. In the past, interior partition wall structures have largely consisted of a sill and lintel member, with a number of regularly spaced upright stud members in supporting relation therebetween. The faces of the partition are then enclosed with sheeting, such as drywall, wallboard etc, which is nailed to the studs and frame members, that range in size from 2 by 3, 2 by 4, 2 by 6, even 2 by 8 being used. The centre-distance spacing of the stud members is usually sixteen inches, so that standard four foot wide sheeting fits edge to edge at the stud centres.

Studs at two-foot centres also may be used in the same fashion.

Generally the members consist of wooden two-by-fours, although in some instances sheet-metal stud members have replaced the wood '2 by 4' stud members.

These traditional structures require large quantities of wood, are bulky and heavy to transport, and expensive.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a wall structure system, and in particular a wall frame structure incorporating load-bearing integrated strut members arranged in

inclined back-to-back contained relation within a containing framework.

The subject integrated strut members are of slender section modulus, such that under typical longitudinal thrust loads they would individually buckle. By arranging the strut members in pairs, having their outer ends joined, and by laterally constraining the strut pairs at their centre-points, the load-bearing capacity of an integrated series of such pairs may be made adequate for the strength requirements of a partition or non-load-bearing wall, the load-bearing 'column' length of each strut being effectively halved.

The lateral constraint for the pairs of strut members may be supplied by adjoining strut pairs in mutual abutting relation, and by some standard frame stud members that may be retained for that purpose.

As an example, an eight foot long section of partition wall normally having seven two-by-four (2X4 – actually 1 ¾ inch by 3 ¾ inch) wood stud members, can have four of the eight-foot 2X4 studs replaced by two assemblies, each consisting of four pairs of the subject inclined strut members. A wooden stud member separates the two strut assemblies as part of the framing, and helps to secure them in place.

Typically, the upper and lower ends of a pair of strut members may be secured to each other, by gluing, sewing or stapling, and glued to the adjoining sill and lintel members of the containing frame; being glued/stapled at their centres to the adjoining pair of strut members, and glued, nailed or stapled to the abutting 2X4 frame side members.

Alternatively, by nailing/stapling and/or gluing the centre portions of the two outer strut members of a strut assembly to the adjoining frame studs, so as to laterally

spread the strut assembly out into its 'working' position, the individual struts can be stabilized in that position by gluing portions of their edges to the abutting face sheeting which encloses the partition wall.

This would consist of spot-gluing edge portions of the strut, at their joined ends and at their planar centre portions, by coating the edges of these parts with glue just prior to applying the face sheeting, on closing the wall structure.

Other means of stabilizing the strut members of an assembly include lateral grooving of the sill and lintel members to receive the strut ends, or the use of spacer strips located between adjacent struts, and secured to the sill or lintel.

In addition to containing the bowing of the combined strut members by way of the framing, the use of a tie member such as metal or wood strapping or a nylon or other high strength filament or wire is contemplated. Such tie members may also serve to position the strut members at their mid-sections.

Strapping tie members may be located beside the struts, to secure the struts at their mid-section lateral edges, while a wire, cable or filament is preferably passed through the centre of each mid-section, and may be secured to each strut, to maintain their spacing, as well as to tie the frame against outward bowing, in the plane of the wall.

The combined strut members may use a variety of materials, one embodiment utilizing a wood-based pressed sheetboard of predetermined thickness and longitudinal stiffness, such as "Masonite" (T.M.). Other material embodiments such as metal or plastic strut members may be readily adopted, in which profiled sections with stiffening side flanges are used. The materials include aluminum sheet.

While a preferred embodiment consists of strut members having two inclined load-bearing portions of its length, it will be understood that multiples of this arrangement may be adopted, with struts having four, six or even possibly eight inclined, load bearing portions along its length.

With adequate lateral stabilization, the adoption of shorter load bearing strut portions has the effect of correspondingly increasing the Euler (buckling) stiffness of the struts. The promotion of lateral strut stability may include the use of plastic foam injected in lateral supporting relation into the interstices of the struts, wherein use is made of the high compression strength of these plastic foams, even those of comparatively low density. Fire and other safety considerations have to be observed, with self-extinguishing foams. Foams also serve to suppress noise transmission.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

Certain embodiments of the invention are described by way of illustration, without limitation thereto other than as set forth in the accompanying claims, reference being made to the accompanying drawings, wherein:

Figure 1 shows a side elevation of a typical section of Prior Art partition wall framework;

Figure 2 is a side elevation of a partially completed partition construction in accordance with the present invention;

Figure 3 is a front perspective view of the Figure 2 embodiment;

Figure 4 is a perspective view similar to Figure 3 of an embodiment incorporating profiled section strut members and a tensioned lateral tie;

Figure 5 is an enlargement of a portion of Figure 4;

Figure 6 is a perspective view of a strut member of the Figure 4 embodiment;

Figure 7 is a side elevation of a partially completed wall section showing the nailing installation of a strut assembly, and an electrical wiring installation;

Figure 8 is an elevation of an enclosed wall section; before taping and plastering; and,

Figure 9 shows a further subject strut embodiment in a wall construction.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figure 1, a typical Prior Art framework 10 of a partition wall has a sill member 12, a lintel member 14, and stud members 16, all of which members are usually of wood, in 2X4 section. Frame sections may range from 2 by 3 to 2 by 8.

In the Figures 2 and 3 embodiment, a prefabricated "concertina" assembly 20 consists of pairs of strut members 22, having their upper and lower outer ends 24 secured together, as by gluing and/or stitching and/or stapling and entered into slots 26 in the sill and lintel members 12, 14 .

The assembly 20 has the mid points 28 of the adjoining outer faces of the members 22 similarly secured in back-to-back relation as part of the fabrication process.

In this embodiment the strut members 22 are originally planar.

In one embodiment the struts 22 were strips of composite panel board, a thickness of 1/8 inch being used. The panel board was of compressed wood particles and plastic resin. Other suitable forms of board may include wood, plywood, fibreboard and oriented strand board. Low density fibreboard is

generally not suited for this use.

A "concertina" consisting of eight strips of board, is made up as four pairs of strip, each pair having their upper and lower outer ends 24 secured together, and adjoining pairs having their mid-section outer surfaces 28 secured together in back-to-back mutually attached relation.

The composite "concertina" of struts is cut to length so as to fit, under axial compression, into the slots 26, so as to fill the aperture of the frame members 12, 14, 16. It will be understood that slots 26 may be eliminated, and gluing and other spacer means may be substituted, to secure the struts in place.

In Figures 4, 5 and 6, the struts 32 are of metal or moulded or extruded plastic, having side flanges 34, with planar end portions 36 and planar intermediate centre portions 38, which may be pre-perforated to accommodate a tensioned member 40. Side reliefs may accommodate straps.

A tensioned monofilament member or wire 40 is shown, the ends of which are secured to the frame side members 16. The member 40 serves to hold outer frame members 16 against outward bowing under the effect of the lateral reaction forces produced by the struts 32, while also retaining the struts 32 in aligned relation with the frame members 16, prior to their being enclosed by the enclosing wall board or paneling.

The struts 32 are shown in a substantially planar condition. However, it will be understood that the ultimate angles of inclination of the end portions 36 and centre portion 38 may be pre-set to substantially the desired angles.

In Figure 7, the normally concealed, behind-the-wall portions of a wall

switch 42, electrical outlets 44 and wiring 46 are shown; also nails 48 that secure the strut concertina assembly 20 to the frame side members 16. Figure 8 shows the manner of closure of a portion of an assembled wall structure, by way of paneling or wall-board, which is nailed, stapled or glued to the frame members. It is at this stage that plastic foam, such as engineering foam with high compression strength may be applied, to limit or prevent buckling deflection of the struts. If used, the foam has a significant noise suppression effect.

The wall joints are then taped and plastered.

In Figure 9, a wall assembly having a doorway and window opening also shows the use of nails to secure the strut concertina assembly 20 to the frame side members 16. The strut assembly 20 shows the use of commercial staples 50 to reinforce the mid-section glued attachment of adjoining pairs of struts in joined relation. The staples 50 may also be used in attaching the strut assembly 20 to the adjoining frame side members 16.

The final step of installing a strut assembly may consist of gluing parts of the strut assembly to the enclosing wall board. This is done as a substitute for, or to reinforce the use of the slots 26. The glue is applied to edge portions of the strut members 22, 32, to secure them to the adjoining drywall, panelboard or other member by which the partition structure is then closed.. This glue application is preferably focused at or adjacent the ends 24, 36 of the struts, and also at the intermediate double-thickness portions 28.

In the illustrated embodiments of Figures 2, 3 and 4, the angle of

inclination of the bowed strut members 22, 32 is approximately 20 degrees, which means that the potential vertical load capacity of each strut member is approximately 94% of its developed longitudinal compressive strength.

Correspondingly, the lateral component of thrust load, which is contained by the frame side members 16 together with the tensioned member 40 (or side strapping when used), amounts in this instance to about a mere 6% of the strut thrust load.

The arrangement of the strut members 22, 32 in inclined, mutually supporting, back-to-back relation, with mid-point stabilization gives two thrust-bearing strut portions, which sensibly halves the Euler (buckling) strut length of each strut portion, with a corresponding increase in load-bearing capacity of the total strut.

For strut members with quarter point stabilization, having four inclined load-bearing segments, the stiffness or thrust load bearing capacity is substantially quadrupled.